

and physics is brought out. The pupil who is fortunate enough to receive instruction on these lines will be placed in the receptive intellectual attitude which should be the aim of all scientific education.

Natural and Artificial Methods of Ventilation. Pp. 66 + xvi. (London : Robert Boyle and Son, Ltd., 1899.)

THERE is a considerable difference of opinion among experts as to the most satisfactory system of ventilation. The system by which fresh, warm air is forced into rooms at the top while foul air escapes at the bottom has been introduced into a number of buildings ; but the compilers of the present volume give extracts and diagrams from papers and reports to show that this method is wrong in principle, and inefficient in practice. It is held that the heating of a building should always be separate and distinct from that of the air supply, and that the only satisfactory means of ventilation is obtained by extracting the vitiated air near the ceilings of rooms, and admitting the fresh air at lower levels. This "natural" system has been successfully introduced by Messrs. Boyle into several public buildings.

Man, the Microcosm. Part I. The Nature of Man. By Leonard Hall, M.A. Pp. 82. (London : Williams and Norgate, 1899.)

DEFINING a monad as any living organism which consists of only one cell, the author's thesis is that man is a community of monads, each of which is a conscious being, and that "human consciousness must consist of the combined and co-ordinated consciousness of the individual monads." The theory is used to explain many facts concerning the nature of man as an individual and as a member of a social community.

The Reliquary and Illustrated Archaeologist. Edited by J. Romilly Allen. New Series. Vol. v. Pp. 288. (London : Bemrose and Sons, Ltd., 1899.)

MANY articles and notes of interest to all students of archaeology are contained in this new volume, comprising the four quarterly numbers issued during the present year. The numerous illustrations of places and objects of archaeological significance add to the attractiveness of a volume which appeals to every one interested in antiquities.

LETTERS TO THE EDITOR.

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Botany and the Indian Forest Department.

In the issue of NATURE of this date I find the second part of Sir G. King's presidential address of Section K, Botany, delivered at the Dover meeting of the British Association. At the end of that address Sir G. King has made a strong attack on the Indian Forest Department, and on the teaching of botany at Coopers Hill College. He maintains that the forest officers trained in this country go out to India with an insufficient knowledge of systematic botany, and that they, on arrival in India, are not encouraged to familiarise themselves with the contents of the forests under their charge.

These assertions are in some respects not in accordance with the facts of the case, and in others they show that Sir G. King, in spite of his long Indian experience, has failed to grasp the real issues. I trust you will permit me to substantiate these two points.

To begin with, Sir G. King puts the cart before the horse. If, as he maintains, the ordinary forest officer educated in England now arrives in India without sufficient knowledge to enable him to recognise from their botanical characters the most well-marked Indian trees, it is chiefly due to the fact that it is

nowadays almost impossible to secure a botanical teacher in this country who can impart the necessary knowledge to the students. Sir G. King feels this himself, hence his lamentations, at the end of his address, over the decay of the study of systematic botany in Britain. I feel sure that Sir W. Thiselton-Dyer will bear me out when I state that no botanical teacher has been appointed to Coopers Hill College except with his, and latterly also with Dr. D. H. Scott's, advice. They have been good enough to recommend to us the gentlemen whom they considered most suitable for our requirements, but, alas ! not one of them, though all were excellent and even famous botanists in other respects, was a systematic botanist in the sense demanded by Sir G. King. Hence I must turn round upon him and say : "Provide well-equipped systematic botanists, and we shall be only too glad to have one of them." In other words, the main difficulty lies with the botanists of the present age, and not with the Forest Department.

On the other hand, we are not free from blame. Until the year 1890 botany was a compulsory subject in our entrance examination, but in that year it was, against my advice, made an optional subject. This, I believe, was due to the influence of the headmasters of our great public schools, who desired to pass their pupils straight into the service, without being obliged to teach special subjects, such as botany. I do not desire to discuss the general question here involved, but I do wish to state that the action in the direction just indicated was decidedly injurious to our special requirements. I am happy to say that during the last year botany has once more been placed amongst those subjects which every candidate for entrance into the forest branch of Coopers Hill College will have to take up.

As for myself, I may state that, ever since I started the forest branch of this College in 1885, I have constantly urged our botanical teachers to extend the study of systematic botany at the expense of other branches, such as physiology. But what with young men trained on the ordinary lines of our public schools, and with teachers with a decided leaning to branches of botany other than systematic, it has been a hard struggle. The otherwise excellent teachers of botany, whom we have had so far, did their best to take up systematic botany on the lines required by us ; but that is a branch not learned in a day, and the first two of our botanists left us, for better appointments than we could offer, when they had fallen in with our requirement.

And yet I think Sir G. King goes too far when he states that the ordinary forest officer educated in England is unable to recognise from their botanical characters the most well-marked Indian trees. Cases like this do, no doubt, occur ; but I am sure that Sir G. King's assertion does not hold good in the case of many of the men who have been sent to India. Indeed, several of them have developed a decided leaning towards systematic botany. At the same time, the task is, in a great part of India, far more difficult than would appear from Sir G. King's words. I should like to know what he understands by "the most well-marked Indian trees." There are some 4000 different species of trees and woody shrubs in Burma, and about half that number in Bengal-Assam. If Sir G. King expects our forest officers on arrival in the country to recognise even a moderate fraction of these species, then he aims at impossibilities, and his enthusiasm for systematic botany has carried him far beyond reasonable limits. To do what he requires demands a thoroughly trained botanical specialist ; and even such a one would require many years to become acquainted with the trees, shrubs and herbs (as demanded by Sir G. King) of an Indian jungle in Burma, Bengal and many other parts of India. For such things the ordinary Indian forest officer has no time.

The statement made by Sir G. King, that the young forest officer on arrival in India is not encouraged to familiarise himself with the contents of the forests under his charge, is not in accordance with the facts of the case. On the contrary, it is made the first duty of the young officer, apart from the study of the language of the people. Sir G. King himself enumerates fourteen forest officers who, during the last thirty years, have done good botanical work. Of these, five have made important contributions to the systematic botany of India. Of the other nine, one was trained at Coopers Hill. Considering that all the men sent out from Coopers Hill are as yet young, and that to my certain knowledge several of them are likely to become botanists, I think Sir G. King's strictures are not justified. Unfortunately,

he looks at the matter entirely from the enthusiastic botanist's point of view.

The Government of India does not wish every Indian forest officer to be a botanist. It is desirable that every now and then one of them should take up the subject as a speciality, but it would be disastrous if all took that line. I have no hesitation in saying that as soon as a forest officer takes up botany as a speciality he is, rare cases excepted, likely to become an indifferent forest officer. The ordinary officer of that class has no time for special botanical study.

Forestry is perhaps not a science in itself, but an industry based upon various branches of science, amongst which botany, geology and entomology are the most important. The forest officer cannot be an expert in each of these. To demand such a thing would be just as unreasonable as to demand that a medical man should be an expert in chemistry. The one is as impossible as the other; to become either takes practically a life-time. With the enormous growth of the several branches of science a very minute specialisation has become an absolute necessity, since only a very small fraction of men can be classed as geniuses, while the rest must be rated at the average capacity of the human race. The student of one branch must depend on the work of students in other branches. Thus the forester, instead of being the assistant of the botanist (as Sir G. King seems inclined to demand), must rely on the professional botanist for all the finer and more intricate problems of botany. All he requires is to acquire a sufficient knowledge of botany, so that he may utilise what the professional botanist tells him. For more he has no time, because he has to attend to quite another class of business. The Indian forest officer is an estate manager on a large scale; he must manage his estates in such a manner that they yield the largest possible amount of useful produce with the least possible outlay. For that end his time is taken up by sylvicultural and administrative duties, leaving but little of it for the special study of any of the branches of science upon which systematic forest management is based.

No doubt many of the pioneers of Indian forestry were botanists, but by no means all. Take, for instance, the protection of the forests against fire, a matter to which Sir G. King gives prominence. He himself states that Lieutenant (now General) Michael was the first who was successful in this direction in Madras. I may add that, as far as Central and Northern India are concerned, Colonel Pearson was the first to introduce successful fire conservancy. And yet neither of these two gentlemen will, I feel sure, claim to be a great botanist.

Sir D. Brandis, to whom, as Sir G. King points out, we owe, for the most part, the organisation of the Indian Forest Department, no doubt was a botanist; but he brought about that organisation, not as a botanist, but as an able forester and administrator of extraordinary energy.

Botany is a branch of science the study of which is most fascinating; but the faculties which produce a great botanist do not necessarily include those which are required to produce a great administrator; and herein lies the difficulty, in so far as the Indian Forest Department is concerned. I could point out more than one botanist who occupied the post of the head of the Forest Department in a province, and who could not possibly be counted amongst the successful forest administrators of India. In nearly all these cases so much time was given to botany that little—or, at any rate, not enough—time remained for the proper administration of the extensive Government forest estates which supply the people of the country with the necessary forest produce, and over and above yield now an annual net revenue of a million pounds. These results would be most seriously imperilled if our Indian forest officers were to take the line which Sir G. King recommends to them.

W. SCHLICH.

Coopers Hill, October 19.

Dark Lightning Flashes.

As an amateur photographer of cloud-scenes, I have taken the image of the setting sun surrounded by clouds on many occasions. I never remember developing a plate in which the image was reversed after an ordinary rapid exposure. Lightning flashes, one would think, ought to be still more rarely reversed, if the chemical reactions of the salts in the gelatine film are solely responsible for the phenomenon; yet dark lightning flashes are not infrequently visible in the developed plates of a thunderstorm.

Dr. Lockyer's interesting photographs (vol. Ix., p. 570) of dark

NO. 1566, VOL. 61]

flashes with bright cores suggest to my mind another interpretation. A lightning flash (and, for the matter of that, an electric spark) is doubtless a complex phenomenon. A disruptive discharge of high tensional electricity through the atmosphere represents, I take it, a core of rarefied (because incandescent) gases surrounded by an envelope of compressed air. Mr. C. V. Boys has shown (NATURE, vol. xlvii. p. 420) that "a wave or shell of compressed air gives rise to an image on the plate in which there is a dark line and a light line within it. Similarly, a wave of rarefaction must produce a light line with a dark line within it." Surely we have then in the lightning flash itself, when rightly illuminated, the necessary data for the production of an image—a bright line edged with two dark lines, as represented in Dr. Lockyer's photographs. In such cases the advantages of a diffused illumination of the background of the scene are obvious. Possibly Mr. S. Bidwell's interpretation of the double flash is the correct one.

Hove, October 21.

W. AINSLIE HOLLIS.

IT seems to me difficult to compare the photographic brightness of the disc of the setting sun with a brilliant flash of lightning. For my part I consider that lightning flashes give us every chance of obtaining photographic reversals, for they can be photographed at very close distances, amounting to a few hundred yards, while the rays from the sun's disc when near the horizon must pass through a long range of dense atmosphere which cuts off the most actinic and therefore photographic rays.

With regard to the second portion of Mr. Hollis' letter, the illustration in my article (NATURE, vol. Ix., p. 573, Fig. 6) disproves rather than proves his suggestion in my estimation. If, as he assumes, the core may be considered the actual spark, and the outer portion the image of the wave or shell of compressed air, then, as the latter is not so luminous as the core, it ought to be best visible by reason of contrast against a bright background. A glance at Fig. 6 shows that this is not the case, for at c the core exists practically alone with an illuminated background, while without the background at A and B it is most developed.

I cannot convince myself that the large dark flash is a double one. A close examination of the negative strengthens the view that it is single, and the general appearance of the ramifications endorses it.

WILLIAM J. S. LOCKYER.

Solar Physics Observatory, South Kensington, October 24.

A Gutta-percha Plant.

IN your issue of October 19 you report a communication made to the French Academy of Sciences by Messrs. Dybowski and C. Fron regarding the cultivation of *Eucommia ulmoides*, a plant said by them to contain gutta-percha. I am naturally much interested in the possibility of this interesting tree, the "Tu chung" of the Chinese, becoming of economic importance, as some years ago I investigated the bark and leaves of this plant with regard to the peculiar cells containing a rubber-like substance (*Trans. Linnean Society*, 1892, vol. iii., part 7).

Gutta-percha and caoutchouc behave very similarly towards many solvents; but the fact that the contents of these cells were dissolved or partially dissolved by turpentine at ordinary temperatures, whereas gutta-percha is only soluble in hot turpentine, led me to the conclusion that the contents of these cells were caoutchouc. This substance is much more frequently met with in the laticiferous cells than gutta-percha, which is almost restricted to the natural order Sapotaceæ. *Eucommia* will therefore, I think, be found to be a rubber, and not a gutta-percha yielding plant.

But in either case it is obvious that, with the opening up of China, this plant may become of great economic importance if, as seems probable from the investigations of Dybowski and Fron, it is easily cultivated and propagated.

F. E. WEISS.

The Owens College, Manchester, October 23.

Halo Round a Shadow.

ON a winter morning some years ago I was driving in a dog-cart from the Lizard across the Goonhilly Downs whilst a dense mist or cloud was matted down on the ground.

Our heads were in bright sunshine, which formed a coloured halo round the shadow of each of our heads on the mist as we travelled on. Half an hour later the mist was more diffused, and we saw a white mist bow in the sky.

HOWARD FOX.

Falmouth, October 28.